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WHEAT PRODUCTIVITY ESTIMATES USING LANDSAT DATA

TYPE II PROGRESS REPORT

12 MAY 1975 - 15 AUGUST 1975

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WHEAT PRODUCTIVITY ESTIMATES USING LANDSAT DATA
TYPE II PROGRESS REPORT
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The following report serves as the first Type II progress report for LANDSAT Follow-on Investigation #2062L which is entitled "Wheat Productivity Estimates Using LANDSAT Data".

This investigation has two primary objectives. These objectives are:

1. To develop techniques and procedures for estimating characteristics of wheat canopies which are correlated with potential wheat grain yield (e.g., leaf area index [L.A.I.], percent vegetation cover, or dry weight biomass) by use of LANDSAT data.
2. To demonstrate the usefulness of LANDSAT data for estimation of wheat yield on a LACIE (Large Area Crop Inventory Experiment) intensive test site.

A. PROBLEMS

Outside of the fact that very little LANDSAT data will be available for the prime test site in Finney County, Kansas because of untimely cloud cover, no special problems exist which are impeding the progress of the investigation.

B. ACCOMPLISHMENTS

Efforts to date have involved field data collection, and a beginning of field data reduction and analysis.

Six trips of approximately 5 days duration each were made to the LACIE intensive test site in Finney County, Kansas by a four-person ERIM team. These trips began in late April (before heading) and terminated with a trip in mid-June. The trips were designed so that the field team could be on location at the time of the LANDSAT (I or II) overpasses.

The first two trips were designed primarily to test field data collection techniques and to develop a working relationship with other participants (ASCS,

Kansas Agricultural Experiment Station, Texas A&M). Specific fields for study were chosen, and farmer's permission to use the fields was obtained, by in-person contact insofar as was possible.

A total of 13 fields were selected for collection of field data. These fields included both irrigated (sprinkler and flood) and non-irrigated (dryland) growing methods, and 3 different wheat varieties (Scout, Eagle, Satanta).

The techniques investigated for measuring leaf area index of a harvested sample included:

1. measuring length and "average" width of components
2. photographing wheat samples and measuring optical density of resulting transparencies and related to area
3. using an electro-optical leaf area meter
4. using the dry weight biomass to infer leaf area.

A "non-destructive" technique for estimating important vegetation canopy parameters was also investigated. The technique which was tried made use of flash telescopic photography and a large mirror to obtain vertical and 45° photos of the canopies. The principal advantage of this technique is not considered to be its "non-destructiveness". More damage is probably done walking into a field than in actually harvesting very small samples. One advantage of a photographic technique is that it produces a permanent record which may be referred to at several points in the investigation in order to reduce and analyze the data in more than one way. Another advantage is that a few 35 mm slides are much easier to handle than the 50-100 tillers of wheat typically collected in a single sample.

As a result of the first trip to the site and analysis of previous years photography, we became convinced that heterogeneity in the vegetation condition within certain fields would make it impossible to describe "average field

condition" with a tractable number of random samples. As a result, we flew over the site in a light aircraft and obtained aerial obliques of the fields of interest in order to stratify heterogeneous fields into homogeneous areas within which samples could be obtained.

Samples of wheat were collected (from 30 cm lengths of rows) from each of 13 fields on four field trips from 5/21 to 6/18. The wheat samples and pictures were brought back to ERIM for analysis. At ERIM, a limited number of hemispherical reflectance measurements were made on the various wheat components (live and dead leaves, stalks and heads), and reflectance measurements of soil (wet and dry) were also made.

C. RESULTS

Preliminary results in reducing the field data suggest the following points:

1. The electro-optical leaf area meter was the most accurate of the approaches tested on harvested wheat samples, but it is very time consuming. Accordingly, it was decided to infer leaf area from dry weight biomass after establishing a relationship between dry weight biomass and area as measured by the leaf area meter.
2. There is a rather good correlation between leaf area as measured by the meter and dry leaf biomass.
3. There is a less consistent relationship between stem area and stem biomass.
4. Projected areas of the components of wheat canopies can be estimated from the ground photography, but there may be difficulty in resolving details in the lower part of the canopy (because it is dark), and there may be difficulties in interpreting whether the vegetation is live or dead in the top part of the canopy (because it tends to be overexposed).

D. PUBLICATIONS

No publications or abstracts of talks were released during the reporting period.

E. RECOMMENDATIONS

Because of the availability of only a small amount of LANDSAT data over the prime site it is recommended that 24-channel scanner data gathered from an aircraft platform at many times during the growing season be provided to fill the time slots when LANDSAT data was not available.

F. FUNDS EXPENDED

Total expenditures through August 15, 1975 are $34,877.

G. DATA USE

	VALUE OF DATA ALLOWED	VALUE OF DATA ORDERED	VALUE OF DATA RECEIVED
USDI EROS DATA CENTER	$12,000	----	----
USDA/ASCS AERIAL PHOTOGRAPHY FIELD OFFICE	$ 1,400	----	----

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